



DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM
WATER QUALITY MONITORING AND ASSESSMENT SECTION
WATERSHED INFORMATION SHEET

Missouri River Mainstem: Kansas City to Glasgow-10300101

Basin Description

This basin consists of the land drained by the Missouri River and its tributaries from just downstream of its confluence with the Kansas River to Glasgow, Missouri. The drainages of the Grand River, Chariton River, and Little Chariton River are not included in the basin. It covers an area of approximately 2,650 square miles, 95 percent of which lies in western Missouri, with the remainder in eastern Kansas. The major tributaries of the Missouri that drain the basin are the Blue River, Little Blue River, Fishing River, Crooked River, Sni-a-Bar Creek, and Wakenda Creek. The only sizable lakes in the basin are oxbows near the Missouri, such as Cooley Lake, Jackass Bend, Sunshine Lake, and Cut-Off Lake. Average annual precipitation in the basin is 35 to 40 inches. Streamflow statistics for the basin are contained in Table 1.

Table 1. Stream Flow Statistics for Missouri River- Kansas City to Glasgow Basin

Stream/Location	Wtrshed. Area (sq.mi.)	Period Of Record	Flow (cfs)			
			90 th Percentile*	Median**	10 th Percentile***	7Q10 Low Flow+
Blue R. at Kansas City	188	1939-2001	280	46	6	
Brush Cr. at Rockhill Rd.	17	1998-2001	34	3.8	1.0	
Brush Cr. at Ward Pkwy.	12.2	1998-2001	27	1.5	0.4	
L. Blue R. nr. Lake City	184	1948-2001	317	48	8.1	0.1
Missouri R. at Kansas City	485,200	1958-2001	95000	49200	25100	
Missouri R. at Waverly	487,200	1958-2001	98600	50000	25700	

* Flow is less than this amount 90 percent of the time

**Flow is less than this amount 50 percent of the time

***Flow is less than this amount 10 percent of the time

+ The lowest average seven consecutive day flow that occurs with a recurrence interval of 10 years.

The Missouri portion of the basin is largely agricultural. Forty-three percent of its land is devoted to row crops, located mainly in the alluvial plain of the Missouri River. Grassland, pasture, and hayfields account for thirty-three percent, and forest or woodland for eighteen percent. Due to Kansas City and the large, heavily developed area

surrounding it, four percent of the basin is considered urban, and one percent is open water.

The basin lies mainly in the glaciated till plains, with the far southwestern portion of the basin in the unglaciated Osage plains. Except for the Missouri River's flat alluvial plain bordered by high bluffs, these plains range from nearly flat to moderately hilly, with occasional small limestone escarpments in the Osage plains. Streams are generally slow-moving and turbid, and many have been channelized.

Near the Missouri River, the surface of the basin consists of silt, sand, and gravel alluvium that the river has deposited in its floodplain. Farther from the river, the eastern part of the basin is largely glacial till, overlain by loess. This loess can be 4-32 feet deep and is generally deepest near the Missouri River. The depth of the glacial till is highly variable, but is generally less than 100 feet on the north side of the Missouri River and less than 50 feet on the south side. The till is mainly clay with some rock and gravel, as well as some occasional sand lenses. The till may be underlain by glacial sand and gravel, and these deposits are then underlain by repetitive Pennsylvanian deposits of shale, shaly limestone and sandstone, and thin coal beds. This shale, limestone, and sandstone forms the surface layer in much of the western part of the basin.

The clayey till and shales ensure that very little water infiltrates to the subsurface. Therefore, most water movement in the basin is through the surface stream network and baseflows to streams are very low during dry periods. Most of the water that reaches the subsurface will resurface locally when a stream valley incises the confining aquatard. There are no notable springs in the basin, but several northern tributaries of the Missouri flow for significant distances within the sand and gravel aquifer of the Missouri floodplain. Therefore, even during dry weather, these streams will often hold substantial amounts of water if the alluvial aquifer is high enough to intercept the streambeds.

Water Quality Concerns

Acceptable water quality is defined by Missouri's water quality standards [<http://www.sos.state.mo.us/adrules/csr/current/10csr/10c20-7a.pdf>]. Streams or lakes that do not meet these standards are considered "impaired". They may not be fit for certain uses, such as swimming, drinking water supply, or protection of fish and other aquatic life. Waters are considered to be "affected" rather than "impaired" if water quality changes are less serious and state standards are not exceeded. These standards also list over 3600 classified streams and over 400 classified lakes in the state. A classified stream is one that is either a permanently flowing stream or one that may stop flowing in dry weather but still maintains large pools of water that support aquatic life. Unclassified streams are the small tributaries to classified streams that do not typically maintain pools capable of supporting aquatic life for the entire year.

Water Quality in Prairie Streams

<http://www.dnr.mo.gov/wpscd/wpcp/watersheds/info/wq-prairie-str.pdf>

Point Source Pollution

Point source pollution is a discharge of wastewater from a single location such as a wastewater treatment plant. Wastewater treatment plants can serve industries, small businesses, subdivisions, mobile home parks, apartment complexes, or entire cities. Wastewater from residential sources such as subdivisions, apartments and mobile home parks is often referred to as “domestic wastewater. It contains primarily treated human wastes, food wastes and detergents. The primary pollutants of concern in domestic wastewater are the amount of organic matter, which is commonly reported as biological oxygen demand (BOD), suspended solids, and ammonia. Industrial and commercial wastewater can be more complex and may contain, in addition to domestic wastes, heavy metals or man-made organic chemicals that can be potentially toxic. Discharges from most municipal wastewater treatment plants are usually a mixture of domestic and industrial/commercial wastewater. Most wastewater plant discharges are also typically high in nitrogen and phosphorus. These two elements act as fertilizers and can cause excessive algae growth in waters receiving these discharges.

Presently there are 79 permitted domestic, industrial, or commercial point sources that discharge a combined 152 million gallons per day (mgd) of wastewater into the waters of the basin. There are 758.1 miles of classified stream in the basin, of which 5.2 miles, or 0.7 percent, are impaired by point source discharges. An additional 2.6 miles, or 0.3 percent, are less seriously affected. Point source discharges impair 1.1 miles of unclassified streams in the basin and affect another 4.7 miles. Discharges visibly affecting 0.5 miles of stream or more are listed in Table 2.

Table 2. Point Sources Impairing or Affecting 0.5 or More Miles of Stream in the Missouri River-Kansas City to Glasgow Basin.

Facility	Stream	Miles Impaired	Miles Affected
Lake Lotawana Lagoon	West Fork Sni-a-Bar Creek	2.0	0
Excelsior Springs WWTF	Fishing River	0	2.0
Oak Grove South WWTP	Horseshoe Creek	1.9	0
Higginsville North Lagoon	Tributary to Tabo Creek	0.3	0.9
Oak Grove North WWTP	Horseshoe Creek	1.0	0
Richmond South WWTF	Tributary to Willow Creek	0.4	0.4
Orrick Lagoon	Keeney Creek	0	0.6
Excelsior Estates WWTF	Tributary to East Fork Fishing River	0.1	0.4
Mayview Lagoon	Tabo Creek	0	0.5
Independence/Rock Creek WWTF	Rock Creek	0	0.5

The main point source pollution concern in the basin comes from the proliferation of many small wastewater treatment plants, primarily in the rapidly expanding Kansas City area. These plants have contributed to excessive amounts of ammonia, suspended solids, BOD, and low dissolved oxygen in their receiving streams. In general, it is preferable for domestic wastewater in large developed areas to be treated at fewer, larger facilities rather than at many smaller ones. With fewer plants come fewer opportunities for faulty treatment. Also, larger plants, which are usually municipally owned, are more likely to have the resources necessary to correct problems.

The U.S. Department of Energy's Kansas City Plant has been a source of polychlorinated biphenyls (PCBs), toxic organic chemicals that accumulate in fish tissue. PCBs are no longer being discharged as a part of routine processes at the plant. Monitoring is in place to detect any PCB discharge that may still occur, and to track discharges of other chemicals. From 1999 to 2002, PCBs were detected 18 percent and 36 percent of the time from two of the plant's outfalls.

Armco Steel, Inc. is a scrap iron processing plant located next to the Blue River about two miles above its mouth. In the past, concerns related to discharges from Armco have included oil and grease and extremes of pH. Armco uses pH neutralization on its acidic process wastewaters, but due to the nature of the facility, the possibility of impact on the Blue River still exists, especially during heavy rainfall events.

Wastewater Treatment

<http://www.dnr.mo.gov/wpscd/wpcp/watersheds/info/wastewater-treatment.pdf>

Nonpoint Source Pollution

Nonpoint source pollution occurs when pollutants enter bodies of water at many locations over a wide area rather than at specific, well-defined points. Examples include the erosion of sediments or the entrance of polluted surface runoff or groundwater into lakes and streams. Locations of nonpoint source pollution are often widely dispersed and are difficult to identify or control.

In prairie streams such as the Missouri River and its tributaries in the basin, some of the major nonpoint source issues are the degradation of aquatic habitat from channelization, other streambank alterations, and loss of riparian corridors. Soil erosion, subsequent instream sediment deposition, and runoff of fertilizers, pesticides, and animal wastes are also concerns. In addition, a major urbanized area such as Kansas City presents special nonpoint source concerns. The only specific nonpoint source affecting one half mile of stream or more is Barber and Sons Aggregates, affecting 0.5 miles of a tributary to Lake Lotawana with limestone-derived sediments.

Habitat impairment is a serious concern in this basin. Of the 758 classified stream miles in the basin, 736 miles, or 97 percent, are considered to be impaired habitat for aquatic life. Causes of this impairment may include channelization, excessive sedimentation

(usually as a result of channelization), loss of aquatic vegetation or associated wetlands, and impoundment. In turn, these proximate causes are usually effects of development and other disturbances of the riparian corridor.

Channelization is the process of straightening a stream or river by removing natural meanders. A channelized stream has steeper slopes, faster streamflow, higher peak flows and lower base flows, resulting in increased erosion and sediment transport when flow is high, and reduced habitat when flow is low. Many rivers and streams in the basin have been channelized. Of 758 classified stream miles in the basin, 204, or 27 percent, are considered channelized. These channelized miles may represent only 50-70 percent of the miles that were originally present.

The Missouri River itself has undergone extensive modification such as narrowing and deepening for the purpose of aiding navigation. These alterations have resulted in the loss of most of the still, shallow backwaters and side channels. The population and diversity of fish and other aquatic life in the Missouri have dropped substantially due to this loss of habitat.

An urban area is largely unable to absorb rainfall. During storms, large amounts of runoff enter urban streams and lakes either directly or through storm sewers. This runoff may carry large amounts of sediment and chemicals such as fuels, lubricants, industrial solvents, household, lawn, and garden chemicals, fertilizers, and pesticides. The Blue River is currently considered impaired for the support of aquatic life due to its levels of chlordane in fish. Chlordane is an insecticide that was heavily used in the Kansas City area. It is no longer used, but still leaches or is washed into waterways.

A 1998-2000 study of the Blue River basin found high levels of *E. coli* bacteria during baseflow. Missouri does not have a water quality standard for *E. coli*, but the U.S. EPA has recommended a limit for full-body contact. Typical *E. coli* concentrations were twice this limit just below the confluence of the Blue River and Indian Creek, in the only segment of the Blue River designated for whole-body contact. Genetic analysis of the bacteria indicated that about 23 percent were of probable human origin, and presumably discharged mainly from wastewater treatment plants. The probable origin of about 49 percent of *E. coli* was found to be dogs or geese. These bacteria most likely enter the streams through nonpoint sources, such as surface runoff.

The majority of the people living in the basin receive their drinking water from the municipal supplies of Kansas City, North Kansas City, and Independence. These supplies are drawn from the Missouri River or its alluvial aquifer. (Water supply intakes from the Missouri itself are located upstream of the mouth of the Kansas River.) Both the river and its alluvial aquifer meet state standards for drinking water supply sources. However, much of the basin draws its drinking water supplies from other shallow groundwaters. These aquifers will be heavily drawn upon with the expansion of the Kansas City metropolitan area. In a 1991 study of private wells in western Missouri that draw from aquifers similar to those used by the southern and southeastern suburbs of Kansas City, about a quarter of wells sampled exceeded the water quality standard for nitrate.

Exceedences of the standard for the pesticide atrazine were very rare, about one percent. These results may reflect groundwater conditions near Kansas City, but this sort of contamination is often caused by local land use practices or surface contamination of the wellhead. It does not usually represent widespread contamination of the underground aquifer. About one third of these wells also had iron or manganese levels that might cause taste or odor problems.

Water Quality Management

The department achieves water quality management of point source pollutants through the issuance and enforcement of wastewater discharge permits. These permits limit the amount of pollutants that can be discharged. All point source wastewater dischargers must obtain a permit and adhere to its discharge limitations. All permits require a level of treatment at least equal to national wastewater treatment standards. In situations where these national treatment standards are not adequate to protect the streams or lakes receiving wastewater discharges, stricter permit limits that do protect these waters are required. The department requires dischargers to conduct regular monitoring of discharge quality and report their results. The department also conducts regular inspections of wastewater treatment facilities and receiving waters.

Nonpoint source pollution is addressed through the state's nonpoint source management plan. This plan is a cooperative project between the Missouri Department of Natural Resources and many other federal, state, and local government agencies, organizations, local landowners, and other interested citizens. The plan emphasizes addressing problems at the watershed level through the use of management practices that control nonpoint source pollution. Some of the most commonly supported practices are those that control soil erosion on tilled land and improve quality and quantity of forage on grazing lands. Others protect riparian zones or control runoff of animal manures, fertilizers, and pesticides. The state nonpoint source management plan is a voluntary program that provides funds, in the form of grants, to help defray the cost of adopting improved management practices. The nonpoint source watershed management projects that have taken place in this basin are described in Table 3.

Table 3. Nonpoint Source Watershed Projects in the Missouri River-Kansas City to Glasgow Basin

Watershed Name	County	Project Date	Pollutants	Watershed Size (Acres)	Acres Needing Treatment	Acres Treated	Percent of Watershed Treated
Palmer Creek	Chariton	1990-94	sed., nut., pest.	10,227	3,713	3,451	34
Lake Creek	Chariton	1990-94	sed., nut., pest.	11,803	6,625	5,182	44
Salt Branch	Saline	1991-95	sed., nut., pest.	2,855	1,691	1,341	47
Burnt Fork	Ray	1993-97	sediment	4,431	2,192	2,046	46
Turkey Creek	Carroll Ray	1997-02	sed., nut., pest.	NA	NA	NA	NA

NA: Information not available.

The Total Maximum Daily Load (TMDL) is a calculation of how much of a pollutant may enter a waterbody without violating water quality standards, and of limits for the discharge of that pollutant from specific sources. TMDLs have been written for chlordane in the Blue River and for ammonia and biological oxygen demand (BOD) in Davis Creek. The Odessa wastewater treatment plant will be receiving new limits for these pollutants in its permit. Other waterbodies in the basin tentatively scheduled for TMDLs are the East Fork of the Little Blue River for total suspended solids (TSS), scheduled for 2004, and the West Fork of Sni-A-Bar Creek for BOD and TSS in 2005.

The flow of the Missouri River through Missouri is largely dependent on the discharge from Gavins Point Dam on the South Dakota-Nebraska border. This dam is managed by the U.S. Army Corps of Engineers. The U.S. Fish and Wildlife Service has suggested decreased flow during the summer to more closely simulate natural conditions for the benefit of fish and wildlife. Lower summer flows on the Missouri could curtail commercial navigation or cause water temperatures to rise above Missouri's temperature standard. It is unclear whether or when this recommendation will take effect.

The Missouri Department of Natural Resources monitors water chemistry and aquatic invertebrate communities at many locations in Missouri. The department also tracks the quality of domestic, industrial and storm water discharges. These monitoring activities provide information on water quality problems, such as their specific location, pollutants, sources and possible solutions. This information guides the management activities the department takes to protect water quality in Missouri.

For more information you can visit the following web sites:

TMDL Fact Sheet

<http://www.dnr.state.mo.us/oac/pub2090.pdf>

<http://www.dnr.state.mo.us/wpscd/wpcp/tmdl/wpc-tmdl-EPA-Appr-date.htm>

United States Geological Survey, Water Resources of Missouri

<http://mo.water.usgs.gov/>

United States Environmental Protection Agency Region 7

<http://www.epa.gov/region7/water/index.htm>

Missouri Department of Conservation

<http://www.conservation.state.mo.us/fish/watershed/crooked/contents/23acotxt.htm>

<http://www.conservation.state.mo.us/fish/watershed/blue/contents/23bcotxt.htm>

United States Army Corps of Engineers, Kansas City District

<http://www.nwk.usace.army.mil/>